CORE

Supersystem: Communications

Station: Cape Canaveral Air Force Station (CCAFS)

Facility: 81900 (Range Operations Control Center [ROCC])

System: Core

Eastern Range System Designator:

COMMUNICATIONS\CCAFS\81900\CORE

External Interfaces:

1. Wideband
2. International Telecommunications Satellite (INTELSAT) Satellite Communications (SATCOM)
3. Data Transmission
4. Transport Management System (TMS)
5. Count, Timing, and Control
6. Digital Voice

1. SYSTEM DESCRIPTION

The Core system is the major communication structure of the Eastern Range (ER). The Core is comprised of five major subsystems that work cohesively to route voice, data, and video around CCAFS and Kennedy Space Center (KSC). This includes telemetry and video from the downrange stations of Jonathan Dickinson Missile Tracking Annex (JDMTA), Antigua, and Ascension to the ROCC. These five subsystems are the Asynchronous Transfer Mode (ATM) Core, Core Access Concentrators, Core Data, Core Video, and Inverse Multiplexers.

1.1 ATM Core

The ATM Core is a Virtual Path Ring (VPR) network configuration which has been designed to transport voice, data, and video using ATM/Synchronous Optical Network (SONET) technology. The virtual path design reflects a dual, redundant ATM/SONET ring with ATM access at each of the nodes. Five primary nodes form the VPR. The primary nodes are the ROCC, XY Facility, Vertical Integration Building (VIB), Southwest Terminal Building (SWTB), and the East Terminal Building (ETB). Equipment at each primary node includes ADC (ADC Telecommunications Company) Synchronous Transfer Node (STN) optical carrier (OC)-48c Cellworx chassis and Element Management System (EMS) interface terminals. The ATM Core also includes sub-tended nodes at numerous facilities on CCAFS. The ATM Core provides the bulk transport for the Core Access Concentrators (AC), Core Video, and Core Data subsystems. Table 1.1-1 identifies the nodes and network support capability for the

ATM Core. An overview diagram of the ATM Core depicting the major subsystems with which it interfaces is shown on Fig. 1.1-1.

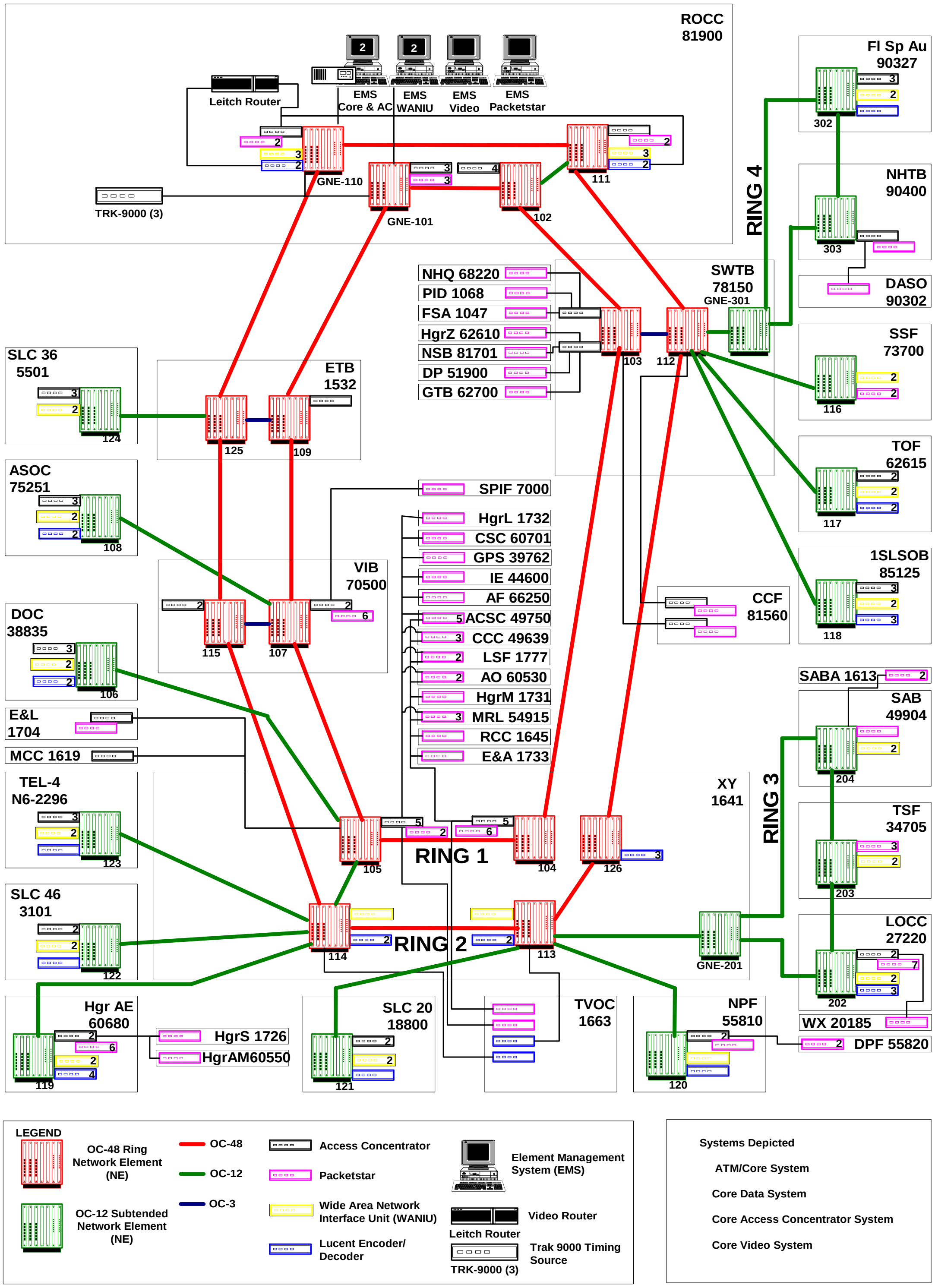

Fig. 1.1-1. CCAFS Core System

The red and green elements, along with the red and green links, are the components of the ATM Core.

Table 1.1-1. Primary and Sub-tended Core Nodes and Major Interfaces
Use JBOSC Facility Manager for more information on Nodes

NODE	FACILITY NUMBER	NETWORK ELEMENT IDENTIFICATION	NUMBER OF COMPONENTS		
			CORE AC	CORE DATA	CORE VIDEO
ROCC	81900	GNE-101, NE-102, GNE-110, NE-111	13	2	4
ETB	1532	NE-109, NE-125	1		
VIB	70500	NE-107, NE-115	10		
XY	1641	NE-104, NE-105, NE-114, NE-113, NE-126	18	2	7
SWTB	78150	NE-103, NE-112	2		
FSA	90327	NE-302	3	2	1
NHTB	90400	NE-303	2		
DASO	90302		1		
SSF	73700	NE-116		2	2
TOF	62615	NE-117	2	2	2
1SLSO B	85125	NE-118	3	2	3
CCF	851560		4		
SABA	1613		2		
SAB	49904	NE-204	1	2	
TSF	34705	NE-203	3	2	
LOCC	27220	NE-202	9	2	3
WX	20185		1		
DPF	55820		2		
NPF	55810	NE-120	3	1	1
TVOC	1663		2		2
SLC-20	18800	NE-121	2	2	1

NODE	FACILITY NUMBER	NETWORK ELEMENT IDENTIFICATION	NUMBER OF COMPONENTS		
			CORE AC	CORE DATA	CORE VIDEO
HgrAM	60550		1		
HgrS	1726		1		
HgrAE	60680	NE-119	8	2	4
SLC-46	3101	NE-122	2	2	1
Tel-4	N6-2296	NE-123	3	2	1
MCC	1619		1		
E&L	1704		2		
SLC-36*	5501	NE-124	3	2	
ASOC	75251	NE-108	3	2	2
DOC	38835	NE-106	3	2	2
NHQ	68220		1		
PID	1068		1		
FSA	1047		1		
HgrZ	62610		1		
NSB	81701		1		
DP	51900		1		
GTB	62700		1		
SPIF	7000		1		
HgrL	1732		1		
CSC	60701		1		
GPS	39762		1		
IE	44600		1		
AF	66250		1		
ACSC	49750		5		
CCC	49639		3		
LSF	1777		2		

NODE	FACILITY NUMBER	NETWORK ELEMENT IDENTIFICATION	NUMBER OF COMPONENTS		
			CORE AC	CORE DATA	CORE VIDEO
AO	60530		2		
HgrM	1731		1		
MRL	54915		3		
RCC	1645		1		
E&A	1733		1		

* Node in process of being deactivated

1.1.1 Virtual Path Ring Network Elements

The VPR Network Element (NE) combines the attributes of a SONET ring with that of an ATM multiplexer (MUX) or switch. The NEs provide SONET virtual path automatic fail over as well as ATM statistical multiplexing capabilities. These characteristics enable the Core to provide a redundant path and efficient bandwidth usage to accommodate all ER data traffic supported by the ring topology. The NEs are deployed as shown in Fig. 1.1-1 and form the high-speed, survivable OC Level 12 and 48 in a concatenated format (OC-12c, 622 megabits per second [Mbps] and OC-48c, 2488 Mbps) VPR backbone of the network. The NEs interface with the ACs, with OC-3c links, and to legacy range hardware with Digital Signal (DS)-3 ATM links. The NE is comprised of the ADC Cellworx Service Transport Node (STN) shelf (also called the VPR Chassis). Important qualities of the VPR NEs include:

- High reliability
- SONET 50 millisecond (ms) Automatic Protection Switching (APS) in the event of a building, fiber, or NE ring node failure
- Efficient bandwidth allocation
- Prioritization of traffic

1.1.2 Element Management System

Sun Microsystem’s Ultra 5 workstations provide the operations control point for the ATM Core and are located in ROCC rooms 189 and 190. In addition to the Solaris operating system, the workstations also run the General Data Comm (GDC) ProSphere EMS software.

1.1.3 Interfaces

The ATM Core interfaces with Core Data, Core Video, Core ACs, and Station Clock. The Core Data is comprised of the Lockheed Martin Mission Systems (LMMS) developed Wide Area Network Interface Unit (WANIU) for routing telemetry data to end-users. The Core Video system is comprised of the Lucent Technologies digital video encoders and decoders for routing of video to end-users. The Core Access Concentrators include both the GDC ACs and the Lucent Packetstar ACs. These devices are ATM switches and can accept ATM and non-ATM traffic, but are principally used to adapt non-ATM traffic into ATM format for transfer onto the VPR backbone. The ACs are used to route traffic to/from the end users and traffic sources. Data in the formats of OC-3c ATM, DS-1, DS-3, Ethernet, RS-232, and EIA-530 is routed through the ACs to/from end users and instrumentation. An OC-3c link provides the network interface to the VPR devices. The Station Clock system is comprised of the TRAK 9000 Global Positioning System (GPS) receivers used to provide reference timing for the ATM Core system.

1.2 Core Access Concentrators

The Core ACs function as the fundamental interface between the digital domain of data and the light (fiber optic) domain of the OC-3, OC-12, or OC-48 of the SONET rings which comprise Core. Acting as an on-ramp to this high-speed optical network, the AC performs all the necessary interfacing, bit interleaving, buffering, and switching to convert high and low data rate digital data into an optically transmitted ATM compliant data cell. These devices are ATM switches and can accept ATM and non-ATM traffic but are principally used to adapt non-ATM traffic into ATM format for transfer onto the Core fiber backbone. The ACs are used to route traffic to and from the end users and traffic sources. Data in the formats of OC-3, ATM, DS-1, DS-3, Ethernet, Recommended Standard (RS)-232, and Electronic Industry Alliance (EIA)-530 is routed through the ACs to and from end users and instrumentation. In Fig. 1.1-1 the black and pink elements are the components of the Core Access Concentrators subsystem.

1.3 Core Data

The Core Data subsystem is a major component of the Core. The Core Data is comprised of the LMMS developed WANIU for routing telemetry data to end-users. The WANIU was designed to interface with the ATM Core. The WANIU provides transport of telemetry data from the Lockheed Martin and Boeing Evolved Expendable Launch Vehicle (EELV) support facilities. These support facilities are the Atlas Space Operations Center (ASOC) for Lockheed Martin’s Atlas V and the Delta Operations Center (DOC) for Boeing’s Delta IV. The WANIUs supporting these facilities are identified as EELV WANIUs. WANIUs located in Tel-4 also receive and transport telemetry data. The WANIU controller is located in Room 190 of the ROCC. In Fig. 1.1-1 the yellow elements are the currently accepted components of the Core Data - WANIU.

1.4 Core Video

The Core Video subsystem provides all equipment necessary to record, digitize, encode, decode, and switch video inputs for transmission across the ER. The Core Video subsystem will also provide for the archiving of voice and video data. The Core Video subsystem consists of Motion Pictures Expert Group –2 (MPEG-2) Video Encoder/Decoder network devices and Windows New Technology (NT) Workstations for operations personnel. The firmware needed to run the video information systems (VIS) equipment is loaded in the Network Interface Modules installed in the equipment.

The Core Video is comprised of the following commercial-off-the-shelf (COTS) equipment:

- Digital Ross Gear Terminal Equipment – DFR-8110A Encoders/Decoders
- Leitch Serial Digital Interface (SDI) Video Router
- Lucent MPEG-2 CODEC (Encoder/Decoder)
- HP OmniBook 4150 Windows NT Laptop
- Compaq Proliant 1850R Server
- Element Management System and Quality Control (EMS/QC) station.

In Fig. 1.1-1 the blue elements are the Core Video nodes.

1.5 Inverse Multiplexers

The Inverse Multiplexers subsystem provides the interface between the WANIU and the Commercial Leased Lines at JDMTA.

2. SYSTEM CAPABILITIES

The Core serves as the backbone communications for ER Instrumentation and Range Customer facilities located at CCAFS and KSC. The Core serves both the Range Customer as well as the Range Safety Mission of the ER. Connections of the ER Range Safety Critical circuits to the Core were accomplished with the intent to meet requirements as specified in Eastern and Western Regulation (EWR) 127-1 and the Space Command Operational Requirements Document (ORD). These requirements include protection against single points of failures, delay, and quality of data.

2.1 ATM Core

The Core and network elements combine the attributes of a SONET ring with that of an ATM multiplexer. These network elements provide SONET virtual path automatic fail-over as well as ATM statistical multiplexing capabilities that enable the Core to provide a redundant path for data as well as efficient bandwidth usage.

The OC-48 is a ring topology, which incorporates a fault tolerant system. With ring topology, the Core accommodates failure of a node by routing data in the opposite direction around the ring. When this occurs, the only transmission capability lost is data coming in and out of the failed node.

The OC-48 and OC-12's together form the backbone of the Core network. The OC-12 is capable of 622 Mbps while the OC-48 is capable of 2488 Mbps.

2.2 Core Access Concentrators

The Core system utilizes two different types of ACs to format and interface low-rate digital data onto the optical SONET network. These ACs are the GDC APEX Access Concentrators and the Lucent Packetstar PSAX 1250 Access Concentrators. Although conceptually identical in their function, the use of two differing models of AC is more indicative of the timeframe in which they were installed within the Core than any fundamental technical differences. The GDC APEX ACs were installed as part of the initial Core installation. These ACs are found, primarily, in major instrumentation and communications nodes such as the XY Facility and the ROCC. The Lucent Packetstar PSAX 1250s, however, were installed afterward and were intended to support low rate data access to the Core network from outlying facilities such as Hangar AE, the Launch Operation Control Center (LOCC) and the Satellite Assembly Building (SAB). Both types of ACs support four ATM service class levels. These are:

- Constant Bit Rate (CBR)
- High priority Variable Bit Rate – Real Time (VBR-RT)
- Medium priority Variable Bit Rate – Near Real Time (VBR-NRT)
- Unspecified Bit Rate – Best Available (UBR)

2.2.1 GDC APEX Access Concentrator

The GDC APEX AC operates by passing data through a combination of Switch Fabric Modules, Slot Controllers, and Line Interface Modules. There are two models of GDC APEX AC used; these are the DV2 (AC) and the IMX (AC). Regardless of the AC model, each GDC AC is comprised of five fundamental components, each of which is configured as removable cards that plug into a main chassis. These components are the Switch Fabric Module, Slot Controller, Cell Controller, Adaptation Controller, and Line Interface Module. Fig. 2.2-1 depicts an exploded view of a typical GDC APEX Access Concentrator.

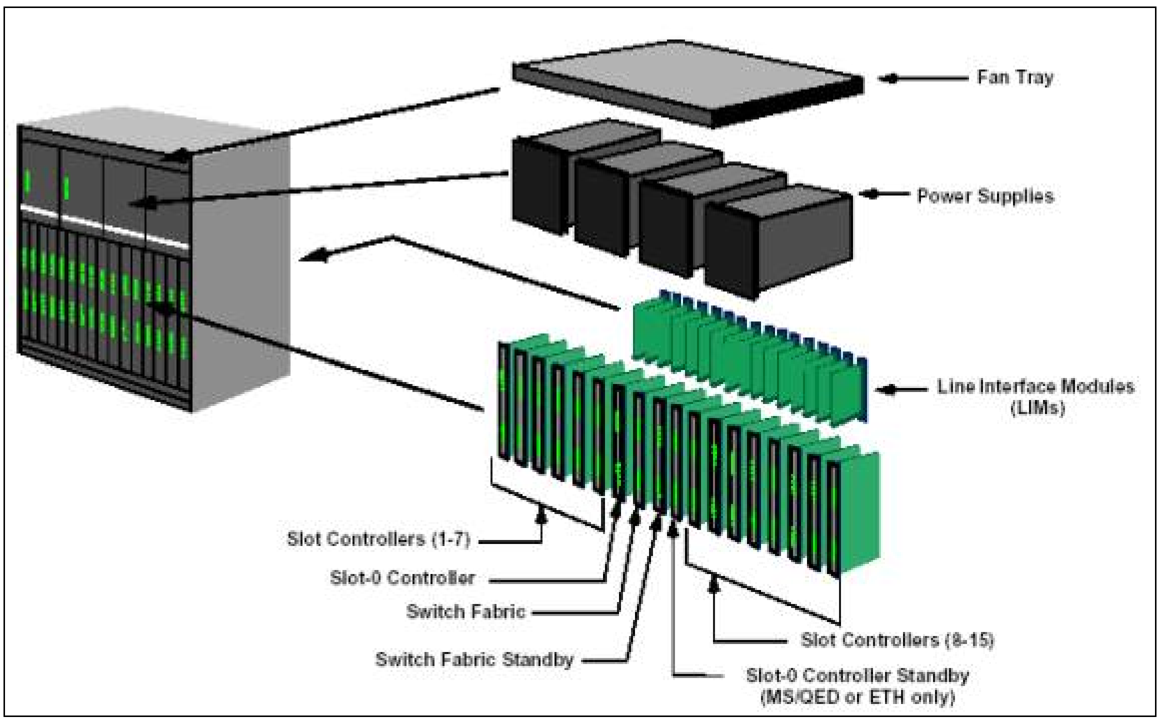

Fig. 2.2-1. Typical GDC APEX Access Concentrator

2.2.2 Lucent Packetstar Access Concentrator

The Lucent Packetstar AC functions by using a central back plane that distributes data, clock signals, and power to the various interface and control modules. The typical Packetstar installation includes modules for redundant power supplies, a control central processing unit (CPU), dual synchronization and common equipment monitoring modules, and input/output (I/O) and server modules. Fig 2.2-2 depicts a typical Packetstar AC installation.

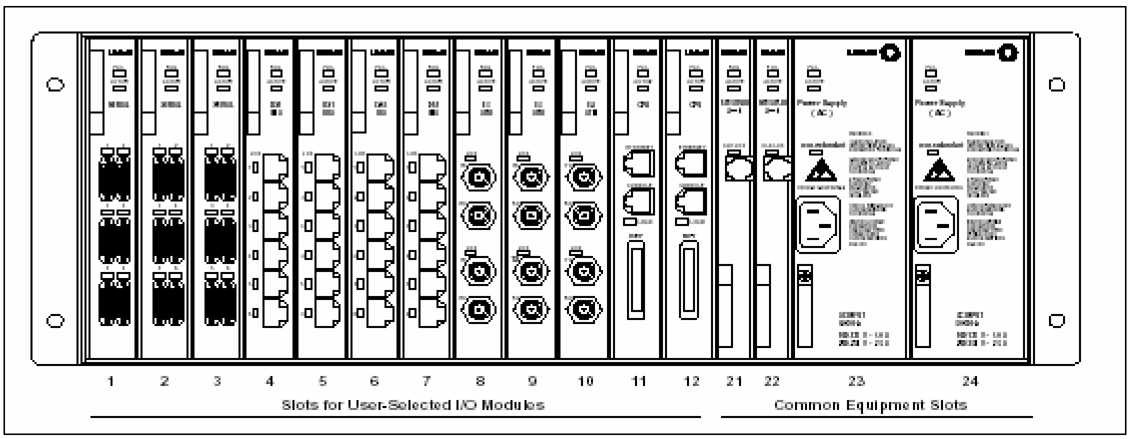

Fig. 2.2-2. Typical Lucent Packetstar Access Concentrator

2.2.3 Line Interface Modules

Both the GDC and Lucent ACs use Line Interface or I/O Modules (LIM) to interface the AC to the network physical layer. This is the I/O point for low and high rate data lines that access the Core for transmission. There are a variety of LIM cards available to interface depending on the data type required. These provide a clear channel connection with software selectable clock rates between 2.4 kilobits per second (kbps) and 8.192 Mbps over the ATM network for devices that support serial interfaces such as:

- RS232
- RS422
- RS423
- RS449
- EIA/TIA530
- V.35
- X21. DCE or DTE
- DS1
- DS3

2.2.3.1 DS1 Line Interface Module

The DS1 LIM is the primary interface for the standard 1.544 Mbps aggregate circuits. This aggregate may be multiplexed from a variety of sources including digital audio from the Digital Range Communications System (DRCS) or an aggregate circuit from a TMS multiplexer. The DS1 (T1) LIMs operate at 1.544 Mbps with a physical interface of one DB-15 connector per port. These LIMs can receive their support timing from three sources: from the received clock, from the system clock reference, or from an internal oscillator on the LIM. In addition, the LIM may loop the receive clock back to the transmit clock and also propagate the derived clock across the back plane of the AC to provide a timing reference for other LIMs.

2.2.3.2 DS3 Line Interface Module

The DS3 LIM can be used to switch ATM cells at 44.768 Mbps, or with the Circuit Emulation Adaptation Controller (CE), to provide up to two ports of DS3 access per controller.

2.2.3.3 Serial I/O Line Interface Modules

The serial I/O LIM operates to provide connectivity for software selectable clock rates between 2.4 kbps and 8.192 Mbps over the ATM network for devices that support serial (RS232, RS422, RS423, RS449, EIA/TIA530, V.35, X21. DCE, or DTE) synchronous and asynchronous interfaces. This is the primary means of interfacing low-rate (<1.544 Mbps) signals onto the Core.

2.2.3.4 Ethernet Line Interface Modules

The Ethernet LIM provides support for the connection of operational Local Area Network (LAN) segments of Ethernet to the Core at data rates up to 10 Mbps. Currently, all administrative LAN connectivity is provided on the ER by means of legacy communications systems and no operational LANs are transported on the Core network.

All LIMs have status light emitting diodes (LED) that show the operational status of each physical port. They also have interfaces to support alarms and performance monitoring. For diagnostic purposes all LIMs have loop back settings from the line and from the controller.

2.3 Core Data

The function of the Core Data subsystem is to transport data through multiple I/O Ports, perform ATM and non-ATM data processing and transfer formatted aggregates through the Network Ports.

2.4 Core Video

The Core Video provides an MPEG-2 Video Encode and Decode subsystem capable of digitizing Range video and formatting it to an interface type that is transportable by the ATM Core backbone system.

2.5 Inverse Multiplexers

The Inverse Multiplexer splits single signals generated by the WANIUs into multiple T-1s for transport across the commercial carriers T-1s to the XY Facility at CCAFS. The T-1s are extended to the ROCC where the data is routed through Inverse Mulitplexers and then routed to WANIUs located at the ROCC.

3. CONCEPT OF OPERATIONS

The subsystems of Core interact to route voice, digital data, and video around the launch area and from the downrange stations of JDMTA, Antigua, and Ascension. Subsequent paragraphs detail the role each of the subsystems performs.

3.1 ATM Core

The Core employs the ATM/SONET methodology for data transfer. The basic building block of this ATM/SONET methodology is the Synchronous Transport Signal (STS). The STS-1 has a transmission rate of 51.84 Mbps. The STS-1 is equivalent to an OC-1. Table 3.1-1 provides a reference for data rates associated with ATM/SONET technology. The STS-1 data format has two parts, which are the Overhead or administration and Payload or the data being transferred. Non-SONET signals are converted to STS Format, routed through the network, and converted back to the user format.

Table 3.1-1. Signal Level and Data Rate Comparisons

SIGNAL LEVEL	DATA RATE (MBPS)	COMMENT
DS-0	0.064	Standard voice channel
DS-1	1.544	24 Standard voice channels
DS-3	44.736	28 DS-1s
STS-1 (OC-1)	51.84	DS-3 with ATM/SONET overhead
OC-3	155	3 OC-1s
OC-12	622	12 OC-1s
OC-48	2488	48 OC-1s

Connecting nodes of the OC-48 ring between ER facilities forms a VPR. This network design reflects a single, redundant ATM/SONET ring with ATM access at each of the nodes. This system is typically used to transfer voice, video, and data between facilities and instrumentation to support ER launch and daily operations.

3.2 Core Access Concentrators

The ACs located at each of the nodes are ATM switches that can accept ATM and non-ATM traffic. They are primarily used to adapt non-ATM traffic to ATM traffic format for transfers onto the Core SONET fiber optic system. The ACs receive and adapt a wide variety of data inputs from OC-3 optical to 2.4 kbps low-rate data circuits for access onto the Core network.

The ACs are one of the network elements that combine the attributes of a SONET ring topology with that of an ATM multiplexer. These network elements provide ATM statistical multiplexing capabilities that enable the Core to provide a redundant path for data as well as efficient bandwidth usage.

3.3 Core Data

The Core Data subsystem provides an interface to the Range User for the transport of telemetry data. This telemetry transport is accomplished using WANIUs as the primary interface and the Core as the data carrier. The function of the WANIU is to transport telemetry data (non-return zero [NRZ] formats) by multiple I/O Ports, perform ATM and non-ATM data processing, and transfer formatted aggregates through Network Ports. The telemetry signals are aggregated and converted for transport by the ATM Core between the ROCC and the EELV facilities.

Timing for the Core Data subsystem is provided by the Count, Timing, and Control system. A TRAK 9000B Global Positioning System Chassis provides a Stratum 1 timing source, which is distributed through a Clock Distribution System (CDS) 20 to an Acroamatics Bit Synchronizer that is used to synchronize the Core Data subsystem.

3.4 Core Video

The Core Video subsystem performs the following five major functions:

1. Digitizes ER legacy National Television Standards Committee (NTSC) analog video to the MPEG II format.
2. Provides the MPEG II Compressed Video to the Core for transport to the end user.
3. Decodes the MPEG II Compressed Video to International Telecommunications Union (ITU)-601, 4.2.2 SDI, and Analog NTSC Video.
4. Distributes the SDI 270 Mbps Video to Virtual Digital Routers and Work Station Monitors.
5. Provides for digital video management.
6. Provides the future capability of MPEG II video archiving.

3.4.1 Video Conversion and Transport

The Core Video subsystem routes both legacy ER video and EELV digital video to end-users. The legacy ER video is comprised of NTSC analog signals. The NTSC was responsible for developing, in 1953, a set of standard protocol for television (TV) broadcast transmission and reception in the United States. The NTSC standards have not changed significantly since their inception, except for the addition of new parameters for color signals. NTSC signals are not directly compatible with computer systems. The legacy video systems of the ER employ the NTSC analog format. The Core Video system ingests this video from the ER legacy video transmission system and converts the signal to MPEG 2 digital format for transport on the Core.

An NTSC TV image has 525 horizontal lines per frame (complete screen image). These lines are scanned from left to right and from top to bottom. Every other line is skipped. Thus, it takes two screen scans to complete a frame: one scan for the odd-numbered horizontal lines, and another scan for the even-numbered horizontal lines. Each half-frame screen scan takes approximately 1/60 of a second; a complete frame is scanned every 1/30 second. This alternate-line scanning system is known as interlacing.

The Core Video system reduces the bandwidth required to transport video by converting the NTSC analog signal to MPEG-2.

MPEG is an encoding and compression system for digital multimedia content defined by the MPEG. MPEG-2 extends the basic MPEG system to provide compression support for TV quality transmission of digital video. The MPEG-2 video compression algorithm achieves very high rates of compression by exploiting the redundancy in video information. MPEG-2 removes both the temporal redundancy and spatial redundancy, which are present in motion video.

Temporal redundancy arises when successive frames of video display images of the same scene. It is common for the content of the scene to remain fixed or to change only slightly between successive frames.

Spatial redundancy occurs because parts of the picture (called pels) are often replicated (with minor changes) within a single frame of video (See Fig. 3.4-1).

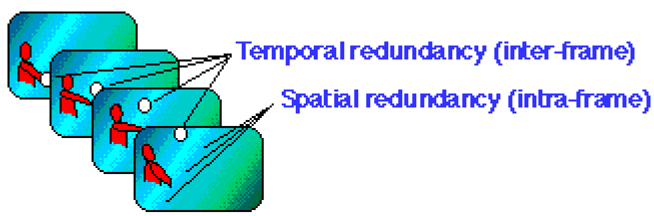

Fig. 3.4-1 Temporal and Spatial Redundancy

Clearly, it is not always possible to compress every frame of a video clip to the same extent - some parts of a clip may have low spatial redundancy (e.g. complex picture content), while other parts may have low temporal redundancy (e.g. fast moving sequences). The compressed video stream is, therefore, naturally of variable bit rate, where as transmission links frequently require fixed transmission rates. The key to controlling the transmission rate is to order the compressed data in a buffer in order of decreasing detail. Compression may be performed by selectively discarding some of the information. A minimal impact on overall picture quality can be achieved by throwing away the most detailed information, while preserving the less detailed picture content. This will ensure the overall bit rate is limited while suffering minimal impairment of picture quality.

The Lucent MPEG-2 Coder/Decoder (CODEC) provides the conversion of the NTSC analog video to the MPEG-2 data stream for routing on the Core. The Lucent CODEC is an integrated MPEG-2/ATM service access system designed to support a variety of video formats. The Lucent CODEC enables video and data sources to be connected to a digital network. It also supports distribution of multimedia traffic over the Core. The

Lucent CODEC uses sophisticated compression algorithms to optimize picture quality and bit-rate efficiency. The source video can be compressed at the rate appropriate for the best possible image quality. Compression rates can be adjusted from 1.5 Mbps for low-complexity video sources to a maximum of 15 Mbps for the highest quality of video containing fast-moving content. With the video converted to a digital format, the video data stream can be routed through the ATM Core for routing to the end-users.

3.4.2 Video Distribution

The Lucent CODEC is capable of converting the MPEG 2 video to SDI ITU-601 Video for distribution in the ROCC by the Leitch Router. SDI ITU-601 video operates at 270 Mbps and uses the ITU-601 or Chroma Sampling methodology. The Chroma Sampling methodology is a variation to the standard digitization and sampling of the NTSC analog video signal. The Chroma Sampling methodology is defined by brightness and the strong color correlation between red, green and blue. The Chroma Sampling or ITU-601 methodology requires 270 Mbps for data transmission.

The Core Video System routes the SDI ITU-601 data to the Leitch router (video switcher) and makes it available for monitors that can accommodate the ITU-601 format. It is also routed to the Ross digital to analog converters for routing through the legacy Video Network Element system.

The Leitch Router is a 128X64 video switcher that switches and distributes video inputs from many sources to the appropriate outputs for display. It can switch signals individually or in groups, or it can configure a single panel. It provides the interconnect for all video signals required for normal operation and provides real-time selection of source video throughout the ROCC and user sites.

3.4.3 Digital Video Management

Located at the ROCC, the digital video Element Management System (EMS) provides the capability to configure CODECs, both locally and remotely, through an Ethernet interface. The EMS will also configure the 128X64 Video Switcher.

3.4.4 MPEG-2 Video Archiving

The MPEG-2 Video Archiving is currently not available, but is a planned modification.

4. OPERATIONAL LIMITATIONS

The Core has supported Range Safety Critical Circuits over the past several months. With operation confidence increased, additional Range Safety Critical Circuits will be transitioned to the ATM Core. Several limitations remain with the Core. These limitations are listed in Table 4-1.

Table 4-1. Operations Limitations of ATM Core

LIMITATION	OPERATIONAL IMPACT
Data latency for 2.4 kilobits (kb) synchronous circuits is approximately 60 ms and exceeds the allocated EWR 127-1 delay requirements.	The ATM Core cannot be used to directly transport low speed Range Safety metric tracking and command system functions. These low speed circuits must be aggregated into a T-1 circuit for ATM Core transport.
WANIU mission configuration file maps do not always load on first attempt.	Delays in mission readiness.
Ability to meet Single Point of Failure requirements for Flight and Mission Critical circuit has not been verified.	Routing of redundant Flight and Mission Critical circuits not presently authorized.
There are signal level incompatibilities between ROSS AEDC-8032A-S cards and legacy video sources.	May not be able to ingest and transmit acceptable video from all existing ER sources. Atlas V and Delta IV first-flight Operations Directive (OD) video requirements have been verified to be of acceptable quality at the time of testing. However, because of unresolved interface issues, the potential exists for color video requirements to be displayed as Black and White video.
The Video system does not meet NTSC specifications for latency due to buffer and optimization settings.	Delay may result in inadequate performance for time critical video and preclude use of Core Video for those functions. At the following bandwidth rates, the round trip latency measurement was as follows: 5 MHz => 1244 ms 10 MHz => 827 ms 15 MHz => 717 ms

5. LOGISTICS

The components of the Core system operate 24 hours a day/7 days a week and require minimal maintenance. Indication of anomalous performance would normally result from notification by end users of the voice, data, video, or telemetry links. Range Technical Services Contract (RTSC) personnel located in the ER Communication Control Center at the CCAFS would be notified of the non-nominal performance and would open a communications trouble ticket in the web-based ER Trouble Ticket program, “Remedy.” Additionally, this downtime would be logged into the Core Automated Maintenance system (CAMS). Complementing notification by the end users, the ATM Core EMS provides alarms for numerous types of failures. Detailed examination of the failure is available on a click down menu approach. ATM Core restorative actions involve the replacement of a failed component with an on-site spare. Unplanned outages are typically corrected within 30 to 60 minutes of detection.